

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the present application.

Listing of Claims:

Claims 1-3 (canceled)

Claim 4 (currently amended): A ~~surface-coated machining tool~~, router cutter consisting of:

a machining tool shank having a blade portion of 3.175 mm or less diameter, the blade portion fabricated from a cemented-carbide base material containing tungsten carbide and cobalt, with the cobalt inclusion amount being 4 weight % or more and 12 weight % or less; and

coated to a given thickness in a single layer over said cemented-carbide base material, a compound thin film made up of a combination of, in given elemental proportions, one or more elements selected from the group titanium, chromium, vanadium, silicon and aluminum, and one or more elements selected from carbon and nitrogen; wherein

said compound thin film is vapor-deposited onto said base material under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness and said given elemental proportions, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 8 GPa or less to said compound thin film,

said compound thin film has a surface roughness of $0.01\ \mu\text{m}$ or more and less than $0.3\ \mu\text{m}$ by indication Ra, and

said predetermined thickness of said compound thin film is $0.05\ \mu\text{m}$ or more and less than $1.5\ \mu\text{m}$.

Claim 5 (currently amended): ~~A surface-coated machining tool,~~ router cutter comprising:

a cemented-carbide base material of 3.175 mm or less diameter and containing tungsten carbide and cobalt, the cemented-carbide base material having a bulk cobalt concentration of 4 weight % or more and 12 weight % or less, the cemented-carbide base material including a cutting surface;

a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to $0.2\ \mu\text{m}$ over the cutting surface of said cemented-carbide base material by a physical vapor deposition method in which graphite is made a raw material, and under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness, are predetermined so as to impart a compressive residual stress of $0.1\ \text{GPa}$ or more and $1\ \text{GPa}$ or less to said compound thin film; wherein

the hard carbon thin film consists of a single layer deposited on the cemented-carbide base material such that substantially the entire hard carbon thin film is in direct contact with the cemented-carbide base material.

Claims 6-7 (canceled)

Claim 8 (previously presented): The surface-coated machining tool set forth in claim 5, wherein said hard carbon thin film is surface roughness adjusted to be 0.01 μm or more and 0.5 μm or less by indication Ra.

Claim 9-11 (canceled)

Claim 12 (original): The surface-coated machining tool set forth in claim 4, wherein the tungsten carbide in said cemented-carbide base material is 0.1 μm or more and 1.5 μm or less in pre-sintering crystal-grain size.

Claim 13 (original): The surface-coated machining tool set forth in claim 5, wherein the tungsten carbide in said cemented-carbide base material is 0.1 μm or more and 1.5 μm or less in pre-sintering crystal-grain size.

Claim 14-15 (canceled)

Claim 16 (original): The surface-coated machining tool set forth in claim 8, wherein the tungsten carbide in said cemented-carbide base material is 0.1 μm or more and 1.5 μm or less in pre-sintering crystal-grain size.

Claim 17-18 (canceled)

Claim 19 (canceled)

Claim 20 (previously presented): ~~A surface-coated machining tool,~~
miniature drill for processing printed circuit boards, the miniature drill comprising:
a cemented-carbide base material of 0.3 mm or less diameter and containing tungsten carbide and cobalt, the cemented-carbide base material having a bulk cobalt concentration of 4 weight % or more and 12 weight % or less, the cemented-carbide base material including a cutting surface;

a hard carbon thin film made up essentially of carbon atoms only, coated to a thickness in the range of 0.05 to 0.2 μm over the cutting surface of said cemented-carbide base material, by a cathodic-arc deposition method in which graphite is made a raw material, and under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 1 GPa or less is imparted to said hard carbon thin film; wherein

the hard carbon thin film consists of a single layer deposited on the cemented-carbide base material such that substantially the entire hard carbon thin film is in direct contact with the cemented-carbide base material.

Claims 21-24 (canceled)

Claim 25 (new): A miniature drill for processing printed circuit boards, the miniature drill consisting of:

a machining tool shank having a blade portion of 3.175 mm or less diameter, the blade portion fabricated from a cemented-carbide base material containing tungsten carbide and cobalt, with the cobalt inclusion amount being 4 weight % or more and 12 weight % or less; and

coated to a given thickness in a single layer over said cemented-carbide base material, a compound thin film made up of a combination of, in given elemental proportions, one or more elements selected from the group titanium, chromium, vanadium, silicon and aluminum, and one or more elements selected from carbon and nitrogen; wherein

said compound thin film is vapor-deposited onto said base material under reaction-gas pressure, base-material bias voltage, and deposition-temperature conditions that, together with said given thickness and said given elemental proportions, are predetermined so as to impart a compressive residual stress of 0.1 GPa or more and 8 GPa or less to said compound thin film,

said compound thin film has a surface roughness of 0.01 μm or more and less than 0.3 μm by indication Ra, and

said predetermined thickness of said compound thin film is 0.05 μm or more and less than 1.5 μm .

Claim 26 (new): A miniature drill according to claim 25, wherein said blade portion is approximately 6 mm in length.

Claim 27 (new): A router cutter according to claim 4, wherein said blade portion is approximately 6 mm in length.

Claim 28 (new): A router cutter according to claim 5, wherein said blade portion is approximately 6 mm in length.

Claim 29 (new): A miniature drill according to claim 20, wherein said blade portion is approximately 6 mm in length.